CLAIMS

1. A method of coating a square wire comprising a step of:

carrying out cationic electrodeposition on a square wire to form an insulating film thereon, by using a cationic electrocoating that stored in an electrocoating bath,

wherein the shifting speed of the square wire in the electrocoating bath is set in a range from 1 to 80 m/min;

the shortest distance from a liquid-contact portion of the square wire onto the cationic electrocoating to an electrode is set longer than 1/2 of the total shift distance of the square wire from the liquid-contact portion of the square wire to a liquid-separation portion in the electrocoating bath,

the cationic electrocoating contains a resin composition of which a hydratable functional group is reduced directly by electrons and passivated, resulting in deposition of a film, and

the cationic electrocoating contains crosslinked resin particles.

2. The method of coating a square wire according to Claim 1,

wherein the crosslinked resin particle being one of which a hydratable functional group is reduced directly by electrons and passivated.

3. The method of coating a square wire according to Claim 1 or 2,

wherein the content of the crosslinked resin particles is 0.5 to 40 % by weight.

4. The method of coating a square wire according to any of Claims 1 to 3,

wherein the crosslinked resin particle is obtained by

emulsion polymerizing an α,β-ethylenically unsaturated monomer mixture using a resin having an onium group as an emulsifier.

5. The method of coating a square wire according to Claim 4,

wherein the resin having an onium group has 2 to 15 onium groups per one molecule.

6. The method of coating a square wire according to Claim 4 or 5,

wherein the resin having an onium group is an acrylic resin or an epoxy resin.

7. The method of coating a square wire according to any of Claims 4 to 6,

wherein the onium group is an ammonium group or a sulfonium group.

8. The method of coating a square wire according to Claim 7,

wherein the acrylic resin or the epoxy resin, having the ammonium group or the sulfonium group, is obtained by adding a tertiary amine compound or sulfide and an organic acid to an acrylic resin or an epoxy resin, having an epoxy group, to convert the acrylic resin or the epoxy resin to a quaternary ammonium compound or a tertiary sulfonium compound.

9. The method of coating a square wire according to Claim 8,

wherein a number-average molecular weight of the acrylic resin or the epoxy resin, having an epoxy group, is 2000 to 20000.

10. The method of coating a square wire according to any of Claims 1 to 9,

wherein the resin composition has a sulfonium group and

a propargyl group.

11. The method of coating a square wire according to any of Claims 1 to 10,

wherein the resin composition has a sulfonium group content of 5 to 400 milli moles, a propargyl group content of 10 to 495 milli moles and a total content of the sulfonium and propargyl groups of 500 milli moles or less, per 100 g of the solid matter in the resin composition.

12. The method of coating a square wire according to any of Claims 1 to 11,

wherein the resin composition includes an epoxy resin having a novolak cresol epoxy resin or a novolak phenol epoxy resin as a skeleton and having a number-average molecular weight of 700 to 5000, and

the resin composition also has a sulfonium group content of 5 to 250 milli moles, a propargyl group content of 20 to 395 milli moles and a total content of the sulfonium and propargyl groups of 400 milli moles or less, per 100 g of the solid matter in the resin composition.

13. An insulated wire of a square wire which is obtained by the method of coating a square wire according to any of Claims 1 to 12.

14. A roll wire which is obtained from the insulated wire of a square wire according to Claim 13.

15. A method of coating a square wire, comprising a step (I) of forming a first insulating film by cationic electrodeposition using a cationic electrocoating, and a step (II) of forming a second insulating film on the first insulating film formed in the step (I) using an insulating coating,

wherein the shifting speed of the square wire in the

electrocoating bath is set in a range from 1 to 80 m/min;

the shortest distance from a liquid-contact portion of the square wire onto the cationic electrocoating to an electrode is set longer than 1/2 of the total shift distance of the square wire from the liquid-contact portion of the square wire to a liquid-separation portion in the electrocoating bath, and

wherein said cationic electrocoating contains a resin composition of which a hydratable functional group is reduced directly by an electron and passivated, resulting in deposition of a film and

said cationic electrocoating and/or the insulating coating contains crosslinked resin particles.

16. The method of coating a square wire according to Claim 15,

wherein the cationic electrocoating contains crosslinked resin particles.

17. The method of coating a square wire according to Claim 15 or 16,

the crosslinked resin particle being one of which a hydratable functional group is reduced directly by electrons and passivated.

18. The method of coating a square wire according to any of Claims 15 to 17,

wherein the content of the crosslinked resin particles is 0.5 to 40 % by weight in the coating.

19. The method of coating a square wire according to any of claims 15 to 18,

wherein the crosslinked resin particle is obtained by emulsion polymerizing an α,β-ethylenically unsaturated monomer mixture using a resin having an onium group as an emulsifier.

20. The method of coating a square wire according to Claim 19,

wherein the resin having an onium group has 2 to 15 onium groups per one molecule.

21. The method of coating a square wire according to Claim 19 or 20,

wherein the emulsifier is an acrylic resin or an epoxy resin.

22. The method of coating a square wire according to any of Claims 19 to 21,

wherein the onium group is an ammonium group or a sulfonium group.

23. The method of coating a square wire according to Claim 22,

wherein the acrylic resin or the epoxy resin, having the ammonium group or the sulfonium group, is obtained by adding a tertiary amine compound or sulfide and an organic acid to an acrylic resin or an epoxy resin, having an epoxy group, to convert the acrylic resin or the epoxy resin to a quaternary ammonium compound or a tertiary sulfonium compound.

24. The method of coating a square wire according to Claim 23,

wherein a number-average molecular weight of the acrylic resin or the epoxy resin, having an epoxy group, is 2000 to 20000.

25. The method of coating a square wire according to any of Claims 15 to 24,

wherein the resin composition has a sulfonium group and a propargyl group.

26. The method of coating a square wire according to any

of Claims 15 to 25,

wherein the resin composition has a sulfonium group content of 5 to 400 milli moles, a propargyl group content of 10 to 495 milli moles and a total content of the sulfonium and propargyl groups of 500 milli moles or less, per 100 g of the solid matter in the resin composition.

27. The method of coating a square wire according to any of Claims 15 to 26,

wherein the resin composition includes an epoxy resin having a novolak cresol epoxy resin or a novolak phenol epoxy resin as a skeleton and having a number-average molecular weight of 700 to 5000, and

the resin composition also has a sulfonium group content of 5 to 250 milli moles, a propargyl group content of 20 to 395 milli moles and a total content of the sulfonium and propargyl groups of 400 milli moles or less, per 100 g of the solid matter in the resin composition.

28. An insulated wire of a square wire which is obtained by the method of coating a square wire according to any of Claims 15 to 27.

29. A roll wire which is obtained from the insulated wire of a square wire according to Claim 28.